CLAIMS

What is claimed is:

1. An automatic gain control comprising:

a digital lowpass filter for filtering a series of digital samples generated by an analog-to-digital converter to generate a lowpass filtered digital sample series;

a power averager coupled to the digital lowpass filter for calculating an average power of the lowpass filtered digital sample series; and

a lookup table coupled to the power averager for setting a selectable gain of an amplifier coupled to the analog-to-digital converter as a function of the average power.

2. The automatic gain control of Claim 1 wherein the digital lowpass filter is an infinite impulse response digital lowpass filter.

3. The automatic gain control of Claim 2 wherein the infinite impulse response digital lowpass filter has a transfer function that may be expressed as:

$$H(z) = \frac{\sum_{m} b_m z^{-m}}{\sum_{n} a_n z^{-n}}.$$

4. The automatic gain control of Claim 2 wherein the infinite impulse response digital lowpass filter comprises:

a first sum function for receiving as input a series of digital samples and for generating a first sum;

a first sum register coupled to the first sum function for storing the first sum;

a first unit delay coupled to the first sum register for delaying the first sum by one sample period to generate a first delayed sum;

a second unit delay coupled to the first unit delay for delaying the first sum by two sample periods to generate a second delayed sum;

a first multiplier coupled to the first unit delay for multiplying the first delayed sum by two;

a second multiplier coupled to the second unit delay for multiplying the second delayed sum by a first constant;

a second sum function coupled to the second unit delay and the first multiplier for generating a second sum;

a second sum register coupled to the second sum function for storing the second sum;

a third sum function coupled to the first sum register and the second sum register for generating a third sum;

a third sum register coupled to the third sum function for storing the third sum; and

a third multiplier coupled to the third sum register for multiplying the third sum by a second constant to generate a normalized lowpass filtered output.

5. The automatic gain control of Claim 1 wherein the lowpass filter attenuates frequencies between half Nyquist rate and Nyquist rate.

6. The automatic gain control of Claim 1 wherein the lookup table sets the selectable gain of the amplifier so that the amplified signal has constant

average power within the dynamic range of the analog-to-digital converter.

7. An automatic gain control comprising:

a first decimator for generating a first decimated digital sample series from a series of digital samples generated by an analog-to-digital converter;

an infinite impulse response digital lowpass filter coupled to the first decimator for filtering the first decimated digital sample series to generate a filtered digital sample series;

a second decimator coupled to the infinite impulse response digital lowpass filter for generating a second decimated digital sample series from the filtered digital sample series;

a power averager coupled to the second decimator for calculating an average power of the second decimated sample series;

and a lookup table coupled to the power averager for setting a selectable gain of an intermediate frequency amplifier coupled to the analog-to-digital converter as a function of the average power.

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8. A method for automatic gain control comprising the following steps:

amplifying a communications signal according to a selectable gain to generate an amplified communications signal;

digitizing the amplified communications signal to generate a series of digital samples representative of the amplified communications signal;

lowpass filtering the series of digital samples to generate a lowpass filtered digital sample series;

calculating an average power of the lowpass filtered digital sample series; and

setting the selectable gain of the amplifier as a function of the average power.

9. The method of Claim 8 wherein the step of lowpass filtering includes lowpass filtering by an infinite impulse response digital lowpass filter.

10. The method of Claim 9 wherein the infinite impulse response digital lowpass filter has a transfer function that may be expressed as:

$$H(z)=\frac{\sum_{m} b_m z^{-m}}{\sum_{n} a_n z^{-n}}.$$

11. The method of Claim 9 wherein the infinite impulse response digital lowpass filter comprises:

a first sum function for receiving as input a series of digital samples and for generating a first sum;

a first sum register coupled to the first sum function for storing the first sum;

a first unit delay coupled to the first sum register for delaying the first sum by one sample period to generate a first delayed sum;

a second unit delay coupled to the first unit delay for delaying the first sum by two sample periods to generate a second delayed sum;

a first multiplier coupled to the first unit delay for multiplying the first delayed sum by two;

a second multiplier coupled to the second unit delay for multiplying the second delayed sum by a first constant;

a second sum function coupled to the second unit delay and the first multiplier for generating a second sum;

a second sum register coupled to the second sum function for storing the second sum;

a third sum function coupled to the first sum register and the second sum register for generating a third sum;

a third sum register coupled to the third sum function for storing the third sum; and

a third multiplier coupled to the third sum register for multiplying the third sum by a second constant to generate a normalized lowpass filtered output.

12. The method of Claim 8 wherein the step of lowpass filtering attenuates frequencies between half Nyquist rate and Nyquist rate.

13. The method of Claim 8 wherein the step of setting the selectable gain includes setting the gain of the amplifier so that the amplified signal has constant average power within the dynamic range of the series of digital samples.

14. The method of Claim 8 wherein the step of digitizing includes sampling the amplified communications signal at a sample rate of at least two times Nyquist rate.

15. The method of Claim 8 wherein the step of digitizing includes sampling the amplified communications signal at a sample rate of at least four times Nyquist rate.

16. The method of Claim 8 further comprising the step of decimating the series of digital samples before the step of lowpass filtering.

17. The method of Claim 8 further comprising the step of decimating the lowpass filtered digital sample series before the step of calculating an average power.